LOW VOLUME IRRIGATION

DESIGN AND INSTALLATION

• GUIDE •

A step-by-step simplified approach to designing and installing low-volume irrigation systems for residential and commercial applications.

ALBUQUERQUE
SEAL
NEW MEXICO
1706

FROM THE MAYOR

Dear Albuquerqueans,

Water is life — particularly in the great Desert Southwest. This precious resource nourishes our bodies, our crops, our wildlife and our landscapes. Water is directly related the remarkable quality of life we enjoy in our beautiful City.

Without a dependable water supply, our quality of life can change swiftly and dramatically. Rather than waiting for a future water crisis, the City of Albuquerque is diligently working to preserve our precious groundwater resources today. We know that our aquifer is depleting faster than it can be replenished, and we've identified several opportunities to conserve this vital resource with minimal sacrifice to our daily lives.

One opportunity is to alter our landscapes and outdoor watering practices. Currently 40 percent of our annual water consumption is poured over our landscapes during the growing season. Since we receive less than 9 inches of rainfall a year, and high-water-use lawns require a minimum of 40 inches annually, we need to make some changes.

The City has developed four free interactive tools to encourage you to make progressive water-use changes now, while we still have abundant choices. Our *How To Guide To Drip Irrigation* is a step-by-step drip irrigation design, installation and management manual. This guide is an ideal companion to the City's Irrigation Training Video and Xeriscape Guide. These tools guide you through the transformation from a lawn-based landscape to a strikingly beautiful drought-tolerant sanctuary for our native grasses, plants and wildlife. In addition, the City's new *Rainwater Harvesting Guide* instructs you on how to take full advantage of the precipitation we do receive.

We've made incredible water conservation progress over the last five years — reducing per capita water use by 22 percent. With your help, we are getting closer to living within our means. Please take advantage of these opportunities . . . and protect the natural beauty of our high-desert environment in the new millennium.

Sincerely,

Jim Baca

Jim Baca, Mayor

INTRODUCTION

Congratulations! You've decided to take the first step in creating a stunning, efficient Xeriscape. Creating a new landscape is a wonderful adventure — an opportunity to embrace the Desert Southwest with the warm colors and textures that lured us here, while respecting the relationship between weather, plant needs and water availability in the Middle Rio Grande Valley.

In addition to using drought-tolerant plants that splash color and texture throughout your yard, you will be installing and operating a water-efficient drip irrigation system. The tasks ahead of you are both exciting and attainable.

Drip irrigation, which can deliver precise amounts of irrigation water directly to the rootzone of plants, has several advantages — most importantly the efficient use of Albuquerque's precious water. Other advantages of drip irrigation include:

- easily installed and modified
- offers relatively low cost of materials
- reduces weed growth
- virtually eliminates evaporation in delivery
- minimizes water runoff, which occurs when water is applied faster than it can be absorbed by the soil
- discourages plant leaf diseases
- uses nutrients more efficiently
- requires smaller, less expensive water meter to operate

This guide will give you specific instructions on planning, designing, installing and managing a drip system. While each xeriscape is unique and individual, the drip irrigation systems that nourish them will operate under the same design, installation and management principles. With this in mind, let's proceed.

For more information on landscaping and xeriscaping, the City of Albuquerque also offers free a Xeriscape Guide, an Irrigation Training Video and a Rainwater Harvesting Guide. The "Complete How-To Guide to Xeriscaping" and the Irrigation Training Video are companion pieces to this manual and provide xeriscape and drip irrigation design basics, planting instructions and specific plant watering needs. These tools detail color characteristics, soil and water needs, and maintenance suggestions for your xeriscape. Free xeriscape workshops are also available during the growing season through the City. Call 768-3655 for a schedule.

TO ORDER:
Albuquerque residents may order this document from the City's Water Conservation Office by calling 505-768-3655 (phone), 505-768-3629 (fax), 768-2477 (TTY) or Relay NM 1-800-659-8331.
www.cabq.gov/waterconservation

If you live outside of Albuquerque, please contact the Office of the State Engineer, Water Use and Conservation Bureau, P.O. Box 25102, Santa Fe, N.M. 87504-5102. Orders may also be placed by phone at 1-800-WATERNM.

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THE IRRIGATION CONSUMER BILL OF RIGHTS

Discuss these items with your irrigation designer and / or contractor before purchasing your irrigation system. This discussion will help you to make wiser selections of design options and equipment selection, and help you understand both your and your contractor / designer's commitment in developing your irrigation system.

CONTRACTOR / DESIGNER QUALIFICA TIONS

- Do the contractor / designer and employees have the necessary license and insurance? To check for contractor licensing in New Mexico use www.newmexlicense.org or call the State Regulation and Licensing Department at (505) 827-7000
- Is the contractor able to secure bonding?
- What are the contractor / designer credentials (formal training, references, professional certification)?
- Does the contractor / designer belong to a local or national trade association and abide by their standards?

DESIGN / INSTALLATION FEATURES

- What is the life expectancy of the system components?
- What safety features have been included?
  - backflow prevention
  - master valve / isolation valve
- What are the options for future upgrades?
  - adding new zones
  - extra wiring
- Does the system meet all local electrical and plumbing codes?

SPECIFIC DESIGN / OPERATING P ARAMETERS

- What will be the distribution uniformity on the irrigated areas? Is water distributed evenly?
  - matched precipitation sprinkler heads
  - head-to-head coverage
  - sprinkler operating pressure
  - slopes
  - wind considerations
- Does the system provide rain override capability or moisture sensors?
- What is the precipitation rate for each zone on the system (quantity of water applied per hour)?
- What is the projected quantity and cost of water used per year?
- What is the recommended programming for the sprinkler system timer / controller?

ESTIMATE

- What does the estimate include?
  - price of system including labor, material, all local taxes and permits;
  - sprinkler system design, specifications, parts list, cut sheets, guarantees;
  - cost of design, if any.

WARRANTIES

- Who provides the equipment installation, start-up and adjustment, and winterization?
- What are the warranties on individual components and system "design" performance?
- Who is providing warranties and what do the warranties cover and exclude?
- Are the providers financially capable of standing behind their warranties?
- What is the availability of replacement parts?
- Does the contractor provide operating instructions to the consumer?

Bill of Rights courtesy of the Irrigation Association as developed by Cal Poly, San Luis Obispo.

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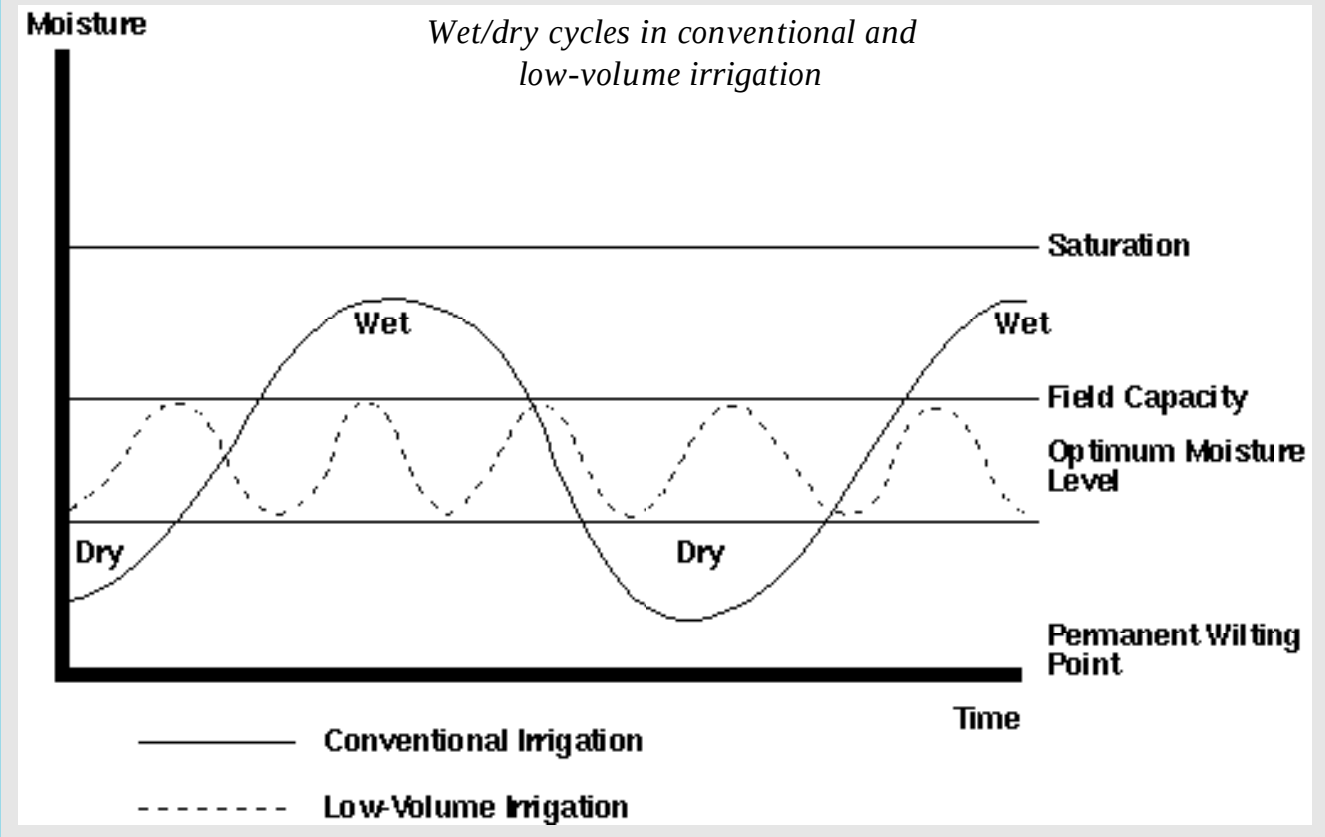


Wet/dry cycles in conventional and low-volume irrigation

When landscape and irrigation professionals refer to low-volume irrigation, they may not be referring solely to drip. Low-volume irrigation encompasses the delivery of water to the landscape through drip, bubbler, microspray and porous tube irrigation methods. To avoid confusion, be sure to refer specifically to drip irrigation when asking a landscape or irrigation professional for guidance.

Drip seems the most practical and efficient of these irrigation methods for the Middle Rio Grande Valley. When properly designed, installed and managed, drip efficiently maintains the optimal range of moisture in the soil at all times, because it applies water in precise quantities on a precise schedule. Groundwater is saved and plants are healthier.

There are six steps to a successful drip-irrigated landscape:

1.) Evaluate your site
2.) Design your plantings
3.) Design your drip system
4.) Install your drip system
5.) Schedule irrigation runtimes / program your controller
6.) Maintain your drip system

TYPICAL APPLICATIONS

Drip irrigation is appropriate for numerous residential and commercial applications. Use this guide in combination with the City's Xeriscape Guide to help select and place specific plants in your landscape. The Xeriscape Guide also can serve as a water-use guide for determining the number and placement of emitters for each of these plant categories.

Desert Accents and Succulents
(low water-use plants in the Xeriscape Guide)

Many of these attractive Southwest species require limited drip irrigation for establishment, then thrive in the Desert with only occasional supplemental water after the first year. These plants are ideally suited for drip. Targeted applications of water nourish plants without unnecessarily irrigating the surrounding landscape.

Flowers and Flowering Groundcovers
(low, medium or high water-use plants in the Xeriscape Guide)

By using drip to place water at the plant base, healthy flowering plants erupt with colorful blossoms, while weeds, grass and other landscape invaders that aren't receiving regular irrigation water decline.

Ornamental Grasses
(low or medium water-use plants in the Xeriscape Guide)

These grasses add green color and attractive winter/summer dimension to your landscape, without requiring excessive watering in the Desert. Their deep roots drink water located lower in the soil profile, requiring less frequent, but longer irrigation runtimes.

Shrubs and Trees
(low, medium or high water-use plants in the Xeriscape Guide)

Because of their size, many of these species may require larger volumes of water. Flow rates for various drip emitter products range from 0.5 gallons per hour to 24 gallons per hour, providing the flexibility to match a variety of tree and shrub watering needs with your system.

SO YOU ALREADY HAVE A SPRINKLER SYSTEM...

Products are available to help you convert lawn sprinklers to multi-emitter drip "hydrants" or 1/2-inch flexible "poly" tube. To decide if conversion is a practical option, consider these issues:

Watering Zone Layout —Be sure you have an entire sprinkler zone that can be dedicated to the drip system. Because of significant variations in required pressures and scheduling, you cannot have sprinkler heads and drip emitters operating off of the same valve.

Valves and Backflow —Many sprinkler valves cannot function properly at low flow rates. Check with the manufacturer or dealer to see if your existing valves are suitable for low-volume applications. You also need to assure that your backflow device can function properly at low flow rates.

Pipes—If your pipes are galvanized metal, consider replacing them with PVC plastic. Galvanized pipes usually have corrosion and mineral flake that can clog emitters. If you have PVC pipes in good condition, they can be used for your drip system.

Filtration—Some manufacturers make specialty devices that replace sprinkler heads. Some of these devices are multi-emitter hydrants that contain built-in pressure regulators and small-capacity filters. If you choose to use these devices as your sole source of filtration, you must commit to clean each device frequently. If you don't use these multi-function devices, you will need to install a pressure regulator and filter (discussed later).

Even if you are performing a conversion, many of the design guidelines in this manual will apply.

STEP 1

EVALUATE YOUR XERISCAPE SITE

Begin the design process for your drip system with some site observations. Pay careful attention to soil type, slopes, microclimates and plant species.

SOIL TYPES

Water travels differently in different types of soil. Knowing your soil "profile" (the top 24 inches of earth) will help you to determine how often and how long to irrigate your plants. Take a moist sample of your soil in hand and push it up your palm with your thumb. This will help you "feel" your soil's texture and determine just what type of soil supports your landscape.

Coarse (sandy and/or gravelly) soils feel gritty or bumpy to the touch. Water percolates downward quickly in this soil type, leaving an egg-shaped, vertical pattern in the soil profile. Horizontal movement of water is minimal; therefore, frequent, short irrigations keep soil moisture levels adequate for healthy plants. Once you irrigate past a plant's rootzone, that water is wasted.

Medium loamy soils feel neither gritty nor smooth. Soil particles in this soil type are closer or "tighter." Water percolates slower, and the soil has better water-holding capacity, leaving a soil profile pattern the shape of a cereal bowl. These soils are more receptive to longer, less frequent irrigations. Always watch for standing water or runoff, which indicate that you're overwatering.

Fine, clay soils feel very smooth in your hand. Water in clay soil tends to spread horizontally, leaving more of a pancake-shaped pattern in the soil profile. Because soil particles are so much smaller and closer together, clay soils have a higher water-holding capacity. If you can match your water application rates to the soil's ability to absorb it, water remains in the soil profile much longer, improving your plants' ability to better utilize it. Drip is a great irrigation tool in tight, clay soils, because the volume of water applied is so small.

Clay soils are notorious for creating irrigation runoff, because water can't seep downward as quickly. If your irrigation system applies water faster than the soil can accept it, water runs down the curb and into the storm drain. If you're experiencing runoff while watering, try watering half the amount, twice as often with some time in between (for example, instead of running one continuous cycle, divide the time in half and run two cycles with a half hour or more between).

Soil Type	Maximum Infiltration	Wetting Pattern Rate	Maximum Wetted Diameter
Coarse (sandy loam)	.72-1.25 inches per hour		1.0-3.0 feet
Medium (loam)	.25-.75 inches per hour		2.0-4.0 feet
Fine (clay loam)	.13-.25 inches per hour		3.0-6.0 feet

Soil Infiltration and Wetting Pattern

LOCAL SOIL TYPES

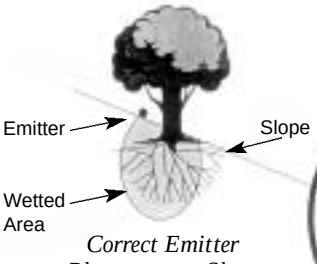
In Albuquerque, there is a wide variety of soils. Generally, you will find coarse, gravelly soils in the Heights. These soils enable irrigation water to percolate down through the profile faster, with less water-holding capacity. Clay and silt loams are common in the Valley. These tighter soils have a greater water-holding capacity, but are more prone to runoff. On the West Mesa, sandy soils tend to offer small, deep wetting patterns with lower water-holding capacity.

Many landscape sites in Albuquerque are prepared with fill dirt of various soil mixtures, and some are heavily compacted by construction and foot traffic. These factors also affect how the soil will accept and hold irrigation water.

Slopes also affect water movement in your landscape, often producing runoff. Hills and berms are particularly suited for watering with drip. On a slope, place your irrigation lines and emitters above the plant material. Pay careful attention to place the emitters within any watering wells that you create around your plants.

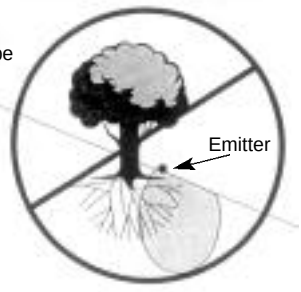
Slopes can create microclimates. Plants on south and west slopes are exposed to more direct sunlight, heat and wind than those on the east and north side of a slope.

In low spots, you may have to adjust how much irrigation water is distributed from your system, as water tends to collect in these areas. This is usually a good location for medium and high water-use plants. Also consider how rain water (off your roof and out of your gutters) can be used to water your landscape. Designed together, drip irrigation and rainwater harvesting systems significantly advance water conservation and healthy plants. The City has produced a Rainwater Harvesting Guide to assist in designing (or redesigning) your landscape to better use the 9 or so inches of Nature's precipitation we receive free.

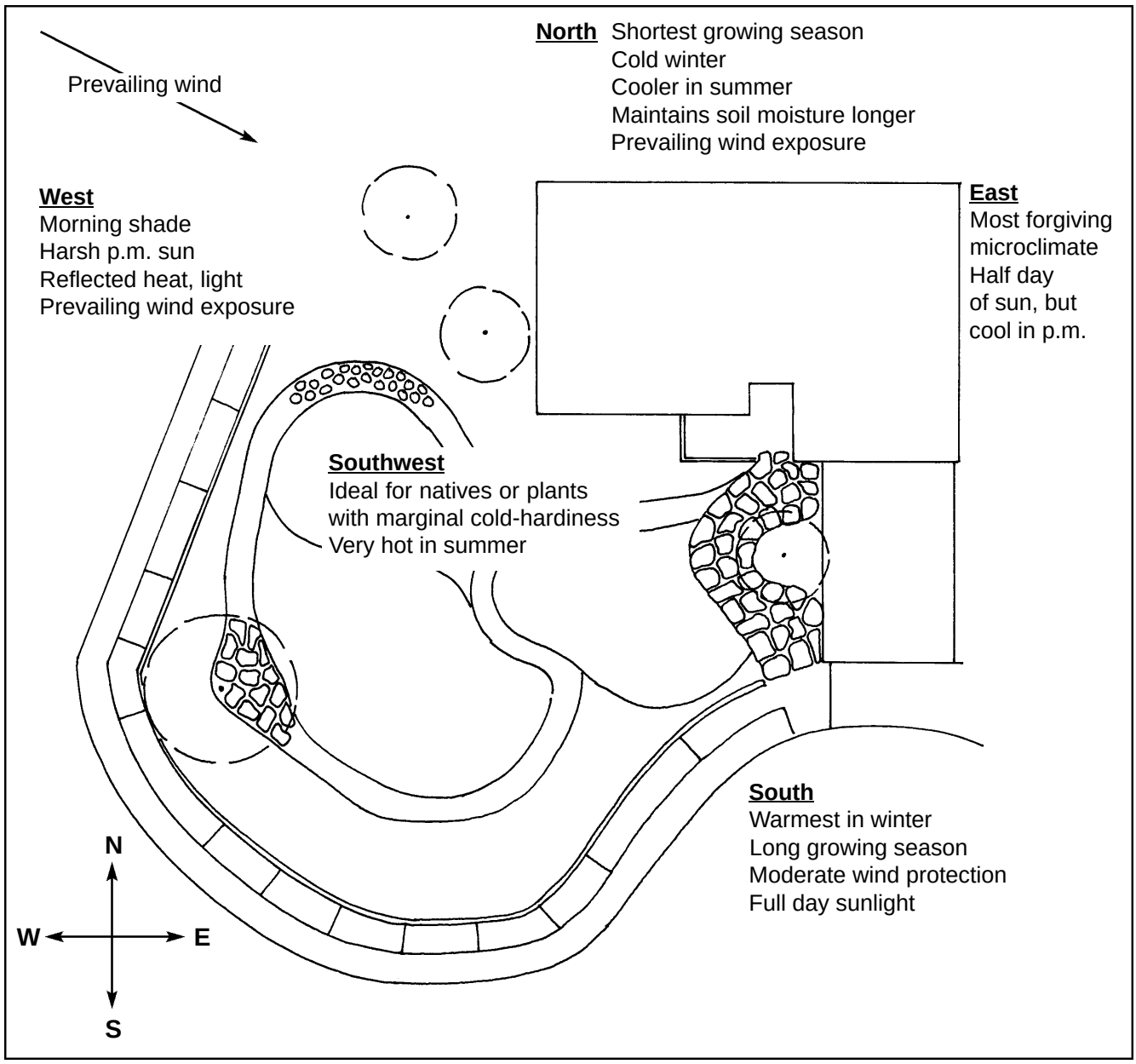


Correct Emitter Placement on Slope

Incorrect Emitter Placement on Slope



MICROCLIMATES IN A LANDSCAPE



MICROCLIMA TES

Most of us understand Albuquerque's climate during the irrigation season (generally March through September): windy, warm springs and falls with occasional cold nights or snow; hot, dry early summers; and hot, humid monsoons in July and August. Annual precipitation averages about 9 inches, much of which falls in the monsoon season, with otherwise sporadic rain and snow events throughout the year.

However, every yard has its own *microclimates* that affect how much water specific plants will need. For example, plants in the south and west areas of your landscape may face hotter, windier conditions than those north and east of buildings, walls, fences or slopes.

Plants in direct sunlight surrounded by asphalt will need more water than those in shady areas on the north side of your home. In upcoming pages, we will help you make irrigation adjustments to compensate for the microclimates on your property. Be sure to consider microclimates in both your planting and irrigation designs.

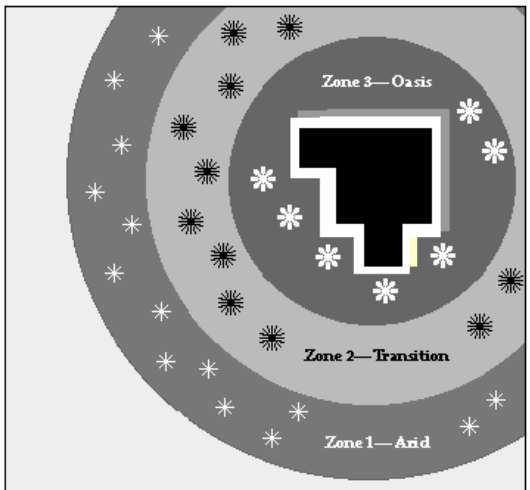
STEP 2

DESIGN YOUR PLANTINGS AND DRIP SYSTEM INTO HYDROZONES

DESIGN OVERVIEW

A simple landscape and irrigation design will help you plan your installation. Once you have a drawing of your design, you can proceed with your landscape conversion at your own pace — without losing sight of your goal. There are no hard-and-fast rules that force you to design and install a landscape in one month, or even one season. Phase it in as time and expenses allow. Take your time. Once installed, your Xeriscape will last for decades.

Design your landscape — and your irrigation system — in zones, grouping plants together based on similar water needs and microclimates. These "hydrozones" don't have to be little bunches of plants dotting your property — they can be grouped in whatever patterns are pleasant and practical for your landscape. In addition to assuring a healthy environment for your plants, hydrozones help simplify xeriscape and irrigation design and management requirements as your yard matures.



The Three Xeriscape Zones

DESIGNING YOUR PLANTINGS

Use the forms in the back of this manual to help design your plant placement. Begin with a detailed plot plan of your xeriscape site. Group plants that can be watered together into low, medium or high water-use hydrozones (try to minimize the use of high water-use zones). In many cases, you will be zoning these plants by their location in the landscape (full sun on the south side, shady areas, windy areas, and so forth). Remember, zoning by water requirement is critical to plant health and effective water conservation. Use the plant list in the City's Xeriscape Guide to identify low, medium or high water-use plants. Knowing the water requirements will tell you the number of emitters to place around each plant.

If you are planting a new site, you can control how your plants are grouped, arranging the landscape so that plants with similar water requirements are grouped together. Then these hydrozones can naturally follow the physical layout of the site. Consider these general hydrozoning principles in your landscape design:

Zone 1 — Mini-oasis: The area nearest to your house is where the highest water-use plants should be placed. Shade and rainfall runoff from your roof can contribute to creating the lushest zone with less supplemental water.

Zone 2 — Transition: The transition zone is used to blend lush areas with the drier parts of your landscape. Try to select low and moderate water-use plants that need infrequent supplemental watering.

Zone 3 — Arid: Feature the most drought-tolerant plants in the arid zone, the driest part of your landscape farthest from your house. Native and drought-tolerant plants are ideal, as they require only deep, infrequent watering after establishment.

Existing sites can be more challenging to design. On many projects, plants with very different watering needs are located next to each other. This is a strength of drip — the ability to target precise applications of water plant-by-plant. For example, if you have an area that contains plants with differing water needs, you may want to group them into separate irrigation hydrozones according to low, medium and high water requirements. These hydrozones can be designed by adjusting the number and size of emitters or by adding more than one independently valved dripline.

Don't overlook the important issues below when you design your landscape (consult your Xeriscape Guide for suggestions):

- Desired mix of deciduous and evergreen plantings
- Adequate space for plants to grow to maturity
- Complimentary or rotating blooming seasons
- Special maintenance needs
- Shade, privacy and wind-block functions
- Wildlife activity
- Pollen and allergenic properties.

STEP 3

DESIGNING YOUR DRIP SYSTEM

A DRIP SYSTEM CONSISTS OF SIX MAJOR COMPONENTS:

1. An automatic controller to program and adjust the frequency and duration of irrigation
2. Filter(s)
3. Low-volume electronic valves for each drip zone
4. Pressure regulator(s)
5. Backflow prevention device(s)
6. A distribution system including a mainline, lateral lines and emitters

THE CONTROLLER

Select an automatic controller that best suits your site and your willingness to regularly use it. Ensure that there are enough stations available to fit the capacity of your irrigation system. It's good planning to have one or more extra stations available for future use, if the time comes when you want to change your landscape or your irrigation capabilities.

Consider the following features for greatest flexibility and water efficiency:

- Digital display to ensure accurate watering times.
- Multiple programs to allow you to water different hydrozones on separate schedules.
- Multiple starting times on each watering day, which can prevent runoff and facilitate new landscape plantings.
- A rain delay program that can automatically reactivate the system after the desired number days.
- Options for even/odd, multi-day interval or day-of-week scheduling, which provide additional scheduling flexibility. For example, watering every other day; every fourth day; or every Thursday and Sunday.
- Water budget feature to allow simple seasonal adjustments by percentage, without reprogramming each irrigation zone.
- Test function to make efficient inspections of all zones.
- Electrical diagnostic function to warn you of faulty wiring.

Visit an irrigation distributor and ask to experiment programming some of their controllers.

Consider the following issues to determine the best location to mount your controller:
1.) Proximity to electrical power;
2.) Ease of routing control wire to the valves;
3.) Ease of accessibility for programming;
4.) Protection from weather, vandals, etc.

FILTERS

The greatest threats to a drip system are debris and particles that can clog emitters. Installing an appropriate filter and performing periodic flushing and filter maintenance will help assure that your system will have a long, trouble-free life. Use a 200-mesh filter for all drip installations unless otherwise recommended by the emitter manufacturer. Filters are best installed upstream of the valves, under full water pressure. This not only protects the valves from debris, but allows you to handle filtration for many valves with a single filter. A sequence of 1) filter, 2) zone valve(s), 3) backflow preventer(s), and 4) pressure regulator(s) will provide the best performance.

AUTOMATIC VALVES

Due to the very low flow rates in drip irrigation, be sure to use low-volume valves. Most manufacturers have valves capable of operating properly at 1 gallon per minute (60 gallons per hour) or less. If you are attempting to convert an existing sprinkler system to a drip system, check the manufacturer's specifications to ensure your existing valves will operate properly at low flow rates. Avoid designing a system that is near the valve's lowest flow range to assure the valve opens and closes more dependably.

Choosing the best location for the valves requires you to consider several factors:

- Appropriate elevation for backflow devices;
- Routing for wires to the controller;
- Accessibility for maintenance;
- Routing and length of irrigation lines;
- Visual and safety impact of protruding backflow devices.

PRESSURE REGULATORS

Too much water pressure can damage your drip system by forcing apart connectors. Most drip equipment is designed to operate at 15 to 30 psi. Most municipal water connections will provide 50 to 100 psi. Pressure can be regulated through pressure regulating devices installed at the valve or just after the valve. If you are retrofitting an existing sprinkler system, some manufacturers make multiple emitter devices that contain pressure regulators and filters.

BACKFLOW PREVENTION

Since your irrigation system will be connected to the public drinking water supply, it is very important to protect the water supply from contaminants. Without proper backflow protection, contaminants could be drawn through emitters or sprinkler heads back into your home. A device called an Atmospheric Vacuum Breaker (AVB) installed downstream of each valve will prevent water from flowing back into your home's plumbing. AVBs must be installed according to local plumbing codes. In Albuquerque, AVBs are not acceptable for use in nonresidential irrigation sytems. In Albuquerque, AVBs must be mounted on galvanized, not plastic, pipes. These devices must be elevated at least 6 inches higher than the highest sprinkler or emitter in the landscape. Contact your local code enforcement office for details.

THE DISTRIBUTION SYSTEM

For long-term durability, consider using PVC pipe installed underground to deliver water to each zone in the landscape. Flexible, black poly pipe should be used only at or near the surface to deliver water directly to the plants, so that any damage to the pipe is quickly identified and repaired. Both 1/2-inch and 1/4-inch poly tubing can be used above ground to deliver water directly to the plants. They are flexible and reliable, and in the finished landscape can be covered by rock or organic mulch (which also help to hold water in the landscape).

EMITTERS

There are several emitter styles to choose from when determining how to apply water directly to the plant material:

1.) Barbed, punch-in emitters, which are the most common, can push directly into 1/2-inch tubing. For ease of inspection and maintenance however, consider punching a barbed *connector* into the 1/2-inch tubing, connect your 1/4-inch tubing to the barbed connector and run it to the desired location beneath the plant's canopy. Then attach an emitter to the end of the 1/4-inch tubing beneath the plant's canopy. This way, emitters are located at the base of the plant and always accessible to you — not buried by landscape fabric and/or mulch, which can complicate any possible changes or repairs later.

Pressure-compensating barbed emitters come in various color-coded flow rates to accommodate individual plant needs. When installing barbed connectors or emitters, you may want a special tool that punctures the 1/4-inch tubing, so you can accurately direct water to each plant with 1/4-inch tubing and then emitters.

DESIGN TIPS

Water distribution can involve some fairly advanced hydraulic calculations. You can avoid problems in your design by following a few basic rules:

- Add up the flow rates for each valve. The flow rate of every valve should be at least 60 gallons per hour (GPH), or 1 gallon per minute (GPM), and not more than 240 GPH, or 4 GPM. ** *Some manufacturers make valves that operate dependably at less than 1 GPM. Consult an irrigation equipment distributor for more information.*
- Don't run 1/2-inch poly tubing for more than 250 feet.
- Don't run 1/4-inch distribution tubing more than 5 feet from the end of an emitter to a plant. For longer distances up to 15 feet, connect 1/4-inch tubing to 1/2-inch tubing with a barbed connector, then install the emitters at the tubing's end.
- Bury long runs of tubing approximately 3 inches beneath the soil or mulch surface.
- Use metal or plastic stakes to anchor drip tubing to the ground.
- Flush all 1/2-inch tubing before installing any emitters.
- Use pressure-compensating emitters to ensure that flows are distributed evenly. Be sure that your tubing and fittings are compatible. Among the manufacturers, there are as many as five different sizes of tubing and fittings.

2.) Multi-outlet emission devices, or hydrants, contain several pressure-compensating drip emitters to which you can attach 1/4-inch tubing that runs directly to each plant. They, too, can be color-coded according to various flow rates. These devices serve as a central point from which 1/4-inch "spaghetti-tubing" is run.

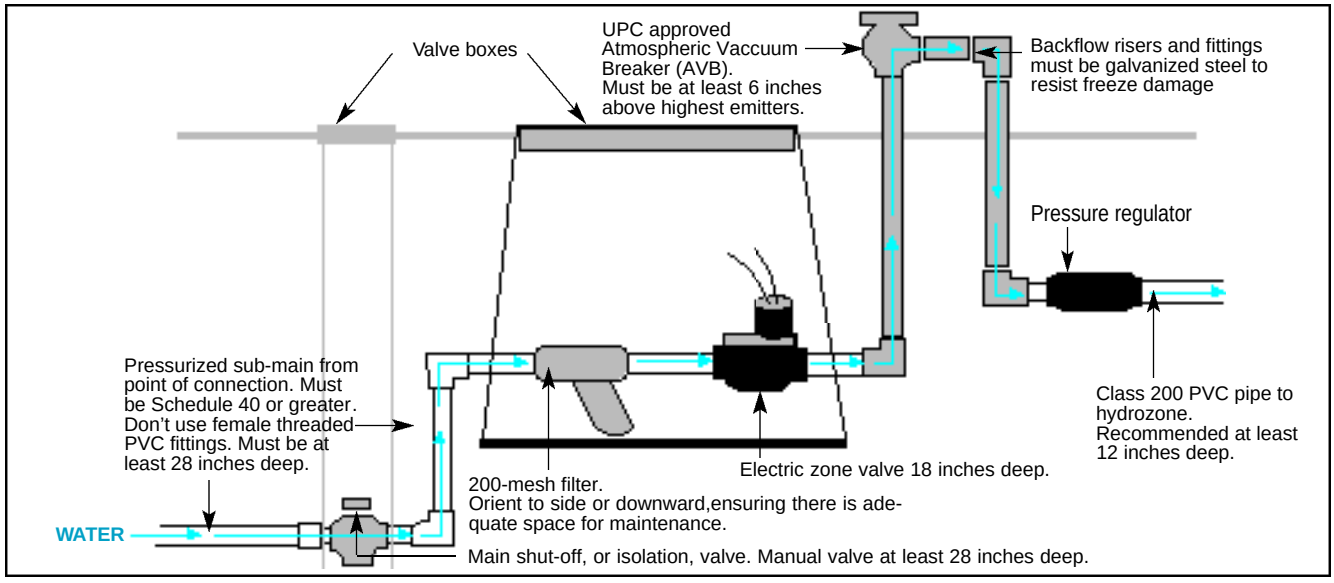
3.) In-line drip emitter tubing has emitters pre-installed at specific intervals (ask a professional) or is available as individual pressure-compensating emitters that attach to 1/4-inch tubing. In this instance, 1/4-inch tubing is snaked through the planted area, and individual emitters are solvent-welded into the tubing at the desired location of emission for each plant.

If installed correctly and inspected regularly, all of these emission devices are water-efficient and easy to work with. Talk to an irrigation professional about what might be best for your project.

STEP 4

INSTALL THE SYSTEM

**NOTE: These installation instructions are general guidelines. Always follow manufacturers' instructions and local codes for the application and installation of specific products.



Installing underground pipe will require that you dig trenches. Lay out your trenching plan on paper and mark key reference points in the yard with flags or landscape paint. If possible, avoid trenching within the dripline of established trees and shrubs. Your mainline trench must be a minimum of 28 inches deep between the point of connection and the valves. Lateral trenches should be approximately 12 inches deep to help protect the pipe from freezing and future excavation damage.

If you are unfamiliar with plumbing techniques and codes, you may require a visit from a licensed plumber. Consult your local city or county building codes for backflow prevention requirements.
In the Albuquerque area contact:
1.) City of Albuquerque Building Safety Division information — 924-3304
2.) Bernalillo County Zoning/Building/Planning Department — 924-3700.

TAPPING INTO THE WATER SOURCE

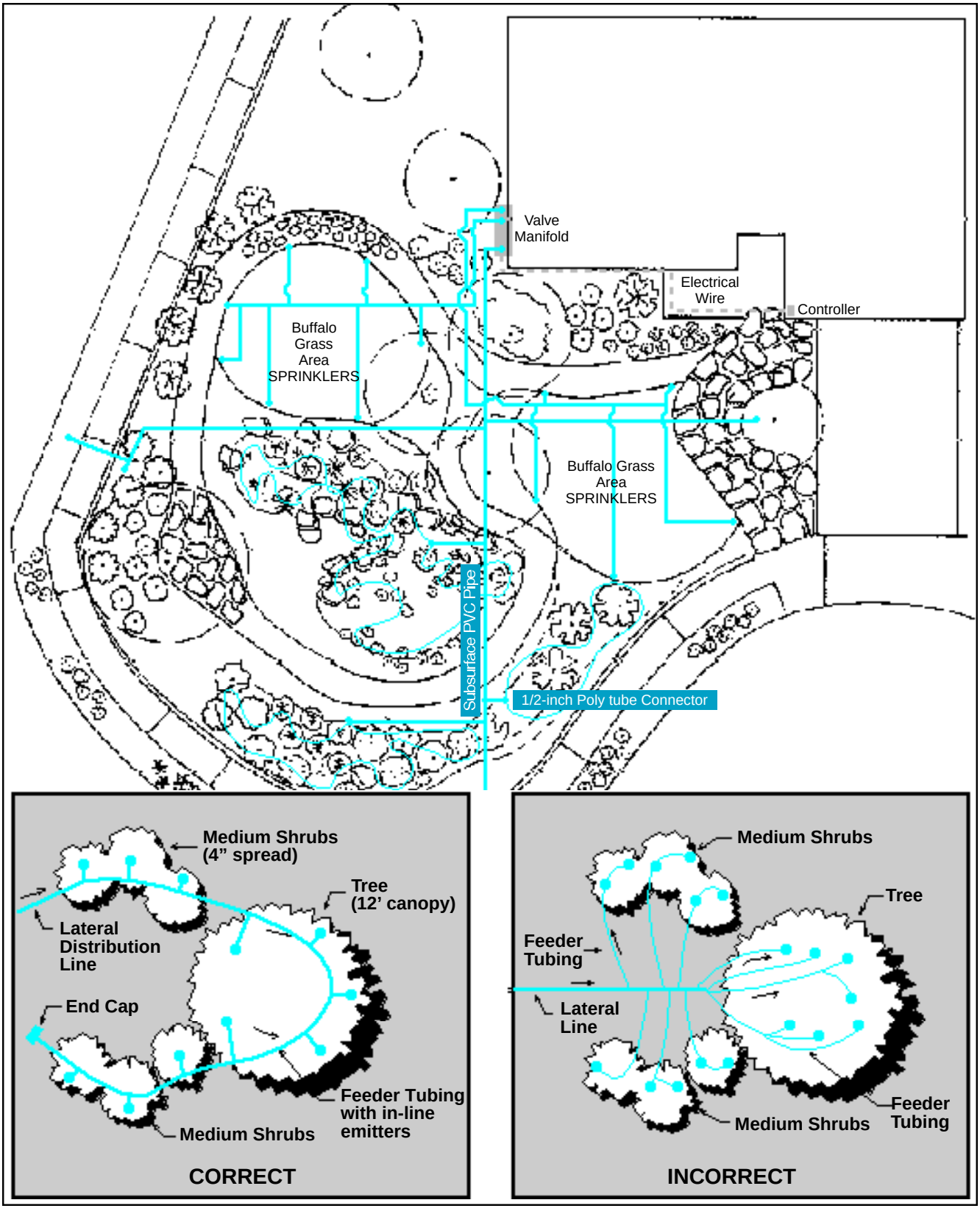
Carefully excavate your home's water service line, which is generally between your water meter outside and your closest water faucet in the home. Oftentimes, newer homes will have a mainline "stub out" buried beneath the hose bib in your front and/or back yard. With the water off, install a point of connection (if in doubt, consider using a licensed plumber), install an "isolation" valve near the point of connection. This manually operated ball or gate valve should be placed within a valve box so that you can make any required sprinkler system repairs without having to turn off the water to your house.

Once the isolation valve is properly installed and closed you can turn on the water to the home and proceed with the remaining sprinkler/ drip system installation. Flush the connection by opening the isolation valve for five to 10 seconds, or until the water runs clear.

From the point of connection, run a main PVC line at least 28 inches deep to the location you have selected in your yard for your irrigation valves and valve box. For most residential applications, 1-inch, schedule 40 PVC pipe is recommended.
After installing your valve(s) to the mainline, install a second isolation valve, which will make it easier to maintain the filter and valves. Allow time for the fittings to adequately cure, then flush the mainline pipe to clear any debris that may have entered during assembly. Next, install your filter. "Y"-style filters (wye strainers) should be installed with the filter canister pointing downward or sideways. A filter installed upward may allow particles to stay in the line while flushing.

IMPORTANT! Before you dig, you must determine the location and depth of all underground utility lines on your property. Start by calling New Mexico One Call at 1-800-321-ALERT. This free service will assist you in locating telephone, gas, electric and cable television lines. The utility and cable companies will come out within a few days and mark the location of their lines on your site.

DISTRIBUTION LINES LAYOUT



THE VALVES

For best results, PVC pipe cutters are highly recommended. These affordable, specialized cutters provide a straight, clean cut. Apply a thin, even layer of primer to soften and clean the pipe, followed by an even layer of solvent cement. Twist together firmly one quarter turn then hold it together for 10 seconds. Wipe away any excess primer or cement with a towel or rag.

IMPORTANT! If you use a saw to cut your PVC, be sure to cut straight and carefully clean away all burrs before applying primer and solvent cement. PVC particles left in the system during installation can quickly plug drip emitters.

BUILDING V ALVE MANIFOLDS

If your system has more than one valve, you'll probably want to purchase a prefabricated "manifold" or construct your own. Connect each valve in a line with PVC pipe, providing as much space between valves as the size of valve box allows. The valve box — installed in the landscape to grade — will ensure that your valves are always accessible, in the event of troubleshooting, repairs or adding zones.

If your landscape design requires more than one valve, or zone, a valve manifold will be the base onto which you will construct your lateral sprinkler or drip zones together. It is generally comprised of 1-inch PVC pipe with "tees" glued in at specific intervals where each valve will attach, then lateral piping zones can be laid out in the landscape.

For threaded PVC fittings, use one to two wraps of teflon-type tape on the male threads (with the threaded end facing you, wrap in a clockwise direction). Do not overtighten PVC threaded fittings; they are the most common source of fitting failures in a sprinkler system.

Use pipe compound for any threaded fittings of galvanized pipe required in the assembly of your backflow preventers. Before installing the valves onto the manifold, flush the system again.

After each valve in your manifold install in order:

1.) your backflow prevention device (usually an atmospheric vacuum breaker for residences);
2.) pressure regulator (usually needed for drip zones).

Water should be delivered out to drip line of plants (on all four sides) for trees to root.

All subsurface piping including valves should be buried a minimum of 18 inches (28 inches from the point of connection to the valve manifold). Your valve box should be buried flush with the ground. Place a layer of gravel in the valve box beneath the manifold to help keep it drained of standing water.

Connect the controller wiring to the automatic valves with water-proof connectors. Test the automatic operation of the valves from the controller before proceeding.

RUN LATERAL LINES TO PLANTED AREAS

After your valve manifold is properly installed and cured, manually activate and flush each valve for 5 to 10 seconds, or until the water is clear (see valve instruction manual). Connect PVC pipe to each valve and out to the appropriate zones in the landscape. Bury all subsurface PVC piping after the valve a minimum of 12 inches. Insert tees or elbows with risers wherever you want to bring water to the surface for poly pipe or emitter hydrants. After fittings have cured, flush the pipe, then temporarily cover all open ends with tape to keep soil or debris out. Perform planting before continuing with the irrigation installation.

RUN DISTRIBUTION TUBING TO PLANTS

After planting each zone, install your 1/2-inch flexible distribution tubing or your multi-outlet hydrants. If you're using 1/2-inch tubing, connect it to the riser via an adaptor and weave it throughout the hydrozone, allowing enough slack for expansion and contraction caused by weather changes. The tubing is easier to work with if you let it warm in the sun for a little while beforehand. Stake the tubing in place. Install a flush cap fitting at the end of the 1/2-inch line, flush the line and replace the cap before continuing.

INSTALL EMITTERS

Install the individual emitters, either barbed or inline. Rather than punching barbed emitters directly into 1/2-inch poly pipe, try inserting a 1/4-inch connector into the 1/2-inch pipe, running 1/4-inch tubing to the plant and then installing your pressure-compensating emitter.

Inline emitters are installed by attaching 1/4-inch tubing to a riser in the planting bed, snaking it loosely around the individual plants, cutting the 1/4-inch tubing with scissors at desired locations around the plants, applying a special solvent and reconnecting the 1/4-inch tubing to run to the next plant. Ultimately these zones are closed loops that connect twice to the riser fitting.

Install your multi-emitter hydrant either at or below grade. For below ground installations, ensure that it is protected by a valve box. Then attach your 1/4-inch tubing (in runs no longer than 5 feet) to deliver water to the individual plants.

TABLE 1

PLANT TYPE	Water Use	Gallons per hour per plant
Flowers and Herbs Up to 2 feet in diameter	Low	0.5
	Moderate	1.0
Small Shrubs Up to 6 feet in diameter	Low	3.0
	Moderate	6.0
Large Shrubs & Small Trees 6 to 10 feet in diameter	Low	6.0
	Moderate	12.0 (minimum 4 emitters)
Large Trees Over 10 feet in diameter	Low	18.0
	Moderate	36.0 (minimum 4 emitters)

Table 1 provides guidelines for the volume of water to be delivered to plants, according to size and watering needs. For example, Table 1 recommends a flow rate of 3.0 GPH for a small, low water-use shrub. The recommended flow rate can be acheived using two 1.5 GPH emitters, three 1.0 GPH emitters or six 0.5 GPH emitters. These guidelines are suitable for most New Mexico climates and soils.

TIP
Space emitters evenly around the plant. They should be placed halfway between the plant's trunk and the edge of its canopy. Use two emitters per plant minimum, except in dense plantings of flowers/herbs.

FINISH THE INST ALLATION

Open all isolation valves and operate the system from the controller to check for leaks and wiring continuity. If system performance is satisfactory, fill and tamp the trenches and smooth the soil surface. Applying water to the backfilled trenches will help settle the soil. Finish grading and clean up the site.

Most drip systems will be covered with mulch to hide the tubing, reduce evaporation and minimize weeds. However, to ensure that your drip system is operating properly, wait a week before adding the mulch. Check that all emitters are operating, and watch plants for signs of stress. After a week, flush the system again and cover with mulch.

STEP 5

SCHEDULING YOUR TIMER

Table 2 provides a sample schedule for the climate in the central Rio Grande Valley. When plants are new, you will need to water frequently for very short durations until plant roots extend into the surrounding soil (about four to 12 weeks, depending on the season). Remember, since your system has enough emitters to sustain full-grown plants, it may take just a portion of the suggested time to thoroughly moisten the limited root-zone of a new plant. Eventually, you will be able to run your drip system for a longer duration, but less frequently. For example, in June, 496 minutes of watering are suggested. If you are watering daily, you would water about 16 minutes per day (496 minutes/30 days). If you are watering every three days, program a runtime of 50 minutes.

The key to effective water management is to water according to weather changes and soil moisture content. The figures in Table 2 are for watering needs in normal, dry, calm weather. This table will give you an accurate runtime adjusted for historical monthly weather patterns in Albuquerque. Water budgeting features on some timers enable you to dial up or down the percentage of your base (in this case, peak-season July demands) watering schedule.

For example, the weather demands on a landscape in September are only 62 percent of the demands in July. The water budget feature enables you to make a simple adjustment to all the watering programs. Water budget adjustments can also be found in table 2.

TABLE 2 – Schedule for Albuquerque, NM, area

Month	Minutes per month	Minutes per week	Water Budget Setting
January*	20	5	5%
February*	34	8	9%
March	76	19	20%
April	146	37	38%
May	243	61	64%
June	337	84	89%
July	558	95	100%
August	380	85	90%
September	341	59	62%
October	234	33	35%
November	49	12	13%
December	24	6	6%

* Normal precipitation is usually adequate to sustain established plants through winter. Some winter watering may be necessary for plantings less than one year old, or if conditions are extremely dry.

Provided you used Table 1 in the design of your drip system, you can use Table 2 as a general operating schedule for established plants in the Albuquerque area. (See scheduling guidelines for other regions of New Mexico in the back of the manual.)

TIPS FOR USING THESE TABLES

Because the *watering time* is dependent upon the *amount of water* the system discharges, any adjustment made to one, must also be made to the other. For example, if your system generates only 30 GPH in total flow, and the minimum recommended flow rate for your valve is 60 GPH, you need to increase the size and/or number of emitters on the system. If you double the flow rates in Table 1 for each plant (to 60 GPH), then you must reduce the suggested runtime from Table 2 in half. Likewise, a 30-percent increase in the flow rate would merit a 30-percent decrease in the watering time.

It may be necessary to water new nursery-grown plants every day or two, but for very brief periods. Ensure that one or more emitters are close enough to the plant to keep the rootball and surrounding soil slightly moist. As plants become more established, water less often, but for longer times, and move emitters outward from the plant as it grows. Supplemental winter watering is recommended for plantings less than one year old. Established plants can be watered monthly during winter months when precipitation is less than 1/2 an inch over the previous month.

Plants native to the desert can die if they receive too much water. Most of these plants will need infrequent or no supplemental water, except during early establishment.

ADJUSTING FOR MICROCLIMATES

To account for microclimates in your landscape, like full sun, shade, next to walls or pavement, and so forth, make the following adjustments:

• If the zone is in full sun throughout the day and/or it is surrounded by pavement or rock, increase your runtimes or emitter output by about 25 percent.

• If the zone is in full shade throughout the day, decrease your runtimes or emitter output by about 25 percent.

IMPORTANT!

While design and installation are critical to the proper performance of a drip system, regular inspection and management are equally necessary to keep your plants healthy and save water. Please adjust your watering monthly, and then to actual weather conditions. If it rains, don't water until the soil sufficiently dries out. If it's windy and you have a zone with sprinklers for grass areas, don't water until the wind subsides or in early mornings/late evenings. In a normal winter, supplemental watering may not be needed.

Remember, these suggested runtimes and days per month are guidelines. Watch your landscape for symptoms of over and underwatering and make watering adjustments accordingly.

If only a few plants seem over or underwatered, consider modifying the number or size of emitters. If most of the plants seem stressed, adjust the programmed runtime at your timer. More xeriscapes fail from too much water rather than not enough. Overwatered plants are usually yellowed, pale and "leggy." Too much water eventually suffocates the roots, causing the plant to wilt much as it would if it were underwatered.

With the exception of yellow leaves, underwatered plants may exhibit similar symptoms. If plants wilt in the mid afternoon or curl their leaves, they are probably too dry. The best diagnostic tool is to simply touch the soil around the root zone. Soil should be as damp as a wrung out sponge, with no excess water. Because most xeric plants evolved in desert regions, they are very forgiving. You will usually have an opportunity to make adjustments before a plant dies.

STEP 6

MAINTAIN THE SYSTEM

THE FIRST FOUR WEEKS

During the first four weeks following installation, *watch plants carefully for signs of stress.* Adjust the schedule for each zone if all the plants on that zone appear stressed. If individual plants look stressed, increase or decrease the number and size of emitters accordingly to correct over- or under watering. Check the wetting patterns around individual plants to be sure that the soil beneath the surface is moist in at least one-half of the plant's canopy area.

Inspect your filters weekly. Drip emitters have very small openings, so it's important to have adequate filters to protect against clogging.

ONGOING MAINTENANCE

Inspect and clean your filters in the spring and fall, and more often if necessary. If your filter appears clogged, gently remove the screen from the casing and scrub it with a soft-bristled tooth brush to remove sediment. If it's damaged, replace it.

Occasionally run your system to visually check the emitters. If an emitter is clogged, clean or replace it. Continue to observe plants for signs of stress, and adjust the system when necessary.

Even with filters, debris can accumulate in the system. Several times each season, remove the endcaps on each zone and activate the valve for about 15 seconds to flush-out debris.

FOR ADDITIONAL INFORMATION

The City of Albuquerque offers free literature and training videos about indoor and outdoor water conservation, plant health, and Albuquerque's water quality and availability. Call 768-3655 for more information.

I. The City sponsors free Xeriscaping seminars every other Saturday during the growing season.
Call 768-3655 for details.

II. There are numerous spectacular Xeriscape sites throughout Albuquerque that demonstrate the beauty of mature drought-tolerant plants.

Xeriscape Demonstration Garden
8201 Osuna NE on the northwest corner of Osuna and Wyoming

Cottonwood Mall
10000 Coors Blvd Bypass NW on the northeast corner of Coors Bypass and Coors Road

Albuquerque BioPark and Botanic Garden
2600 New York on the northwest corner of Central and New York near the Rio Grande

Western Mobile Lafarge Corporation
Xeriscape Garden
6211 Chappell NE

High Desert Demonstration Garden
13000 Academy NE

Pavilions at San Mateo
San Mateo and Cutler NE, just north of I-40

III. Most major irrigation manufacturers offer detailed equipment specifications and how-to information on the Internet.

IV. Local landscape and irrigation professionals are a tremendous resource for information. They can answer questions regarding locating, purchasing, planting and maintaining plants and irrigation equipment.

Information contained in this Guide is based upon generally accepted formulas, computations and trade practices. If any problems, difficulties or injury should arise from or in conjunction with the use or application of this information, or if there is any error herein, typographical or otherwise, the City of Albuquerque or any agent or employee thereof, shall not be responsible or liable.

TROUBLESHOOTING

PROBLEM	POTENTIAL CAUSE	SOLUTION
Valve does not operate properly .	Check controller to ensure power is on. Check that isolation valve is open.	
	Wrong valve selected — flow too low.	Replace with correct size valve for flow.
	Valve diaphragm is clogged.	Clean or replace diaphragm.
	Solenoid is faulty or wire is severed.	Check wiring. Repair or replace solenoid.
Emitter has uneven or no flow .	Line severed upstream of emitter.	Check for breaks and repair.
	Filter clogged or inadequate.	Check, clean or replace filter.
	Emitter clogged or faulty.	Flush or replace emitter.
	Pressure too high or too low.	Check pressure regulation.
	Too many emitters on one line or line sized improperly for flow.	Check and correct.
Tubing comes apart at fittings.	Fitting improperly installed.	Check and replace.
	Pressure too high.	Check pressure regulation.
	The size of tubing and fittings is incompatible.	Check and correct.
Emitters come loose from tubing.	Emitter installed improperly.	Check and replace.
	Pressure too high.	Check pressure regulation.
	Faulty or worn hole punch.	Check punch tip and replace. Replace bad section of tubing. Install oversize plug.
Plant(s) appear stressed.	Emitter(s) are on low side of slope.	Move emitter(s) to the high side of slope.
	Emitter at plant is clogged.	Clean or replace emitter.
	Filter is clogged and preventing flow through the lines.	Clean or replace filter.
	Break in line upstream of the emitter.	Check for breaks and repair.
	Runtime inadequate for plant and / or time of year.	Recalculate water requirement and adjust schedule.
	Runtime is excessive for plant and / or time of year.	Recalculate and adjust schedule.
	Controller faulty, turned off or unplugged.	Check controller and reset, repair or replace.
	Emitter has strayed from rootzone.	Restake or anchor emitter properly.

RECOMMENDED MAINTENANCE

INTERVAL	ACTION
Design / installation.	Consider accessibility of valves, filters and emitters for adjustments or repairs. During installation, ensure that components are placed for easy access. Completely flush the system prior to operation to remove all debris. Be careful to keep pipe shavings and burrs from PVC out of the lines.
Weekly during first four weeks of operation.	Inspect and clean filters. Establish a cleaning schedule based on the amount of debris found during inspections. Inspect plants for signs of stress. Run system and carefully check all emitters for proper operation. Listen for running water that could indicate breaks in lines. Adjust emitters to ensure that wetting patterns are within plant rootzones.
After the first two weeks of operation.	Flush lines and look for debris in the water, which could indicate breaks in the lines or failed filters.
Every month	Make scheduling adjustments according to historical weather data (page 22).
Every one or two months.	Examine and clean filters. Replace filters if necessary. Walk through your landscape and look for signs of plant stress. Check all emitters for location and flow. Adjust, clean or replace emitters as required.
Every two to four months.	Flush all lines. Examine water sample for debris. Flush until water runs clear (should only take a few seconds).
Spring and Fall	Inspect drip or sprinkler system for leaks or breaks. Clean filter screens.

GLOSSARY

1/2 or 3/4-inch tubing
A low-volume distribution component typically used to bring water from a riser into a hydrozone. Self-piercing emitters punch directly into this tubing.

1/4-inch tubing
A low-volume distribution component typically used to bring water directly to the plants (in runs no longer than 5 feet). Also known as "spaghetti" tubing.

Backflow preventer
A device that stops water in the irrigation system from backing up into the water supply during a sudden loss of pressure. Required by code in one form or another, these devices protect public health and safety by preventing water system contamination and pollution.

Clock
See "Controller."

Controller/Timer/Clock
A device used to program days of the week, times of day and number of minutes, to automatically irrigate your landscape according to seasonal weather and plant needs. Controllers communicate with your valves via field wiring.

Drip emitter
A low-volume emission device that delivers water at low flow rates. Drip emitters are used to apply water directly to an individual plant rootzone.

Filter
A device used to screen dirt and debris from the water. Filters are important in low-volume systems because the small emitters can easily become clogged.

Flow
The amount of water, usually measured in gallons per minute or gallons per hour, that can pass through an irrigation system.

GPD
An abbreviation for Gallons Per Day as required by landscape plants, and used to formulate irrigation schedules.

GPH
An abbreviation for Gallons Per Hour, a measure of the flow of water through an irrigation system. GPH is typically used to measure flow in low-volume irrigation systems.

GPM
An abbreviation for Gallons Per Minute, a measure of the flow of water through an irrigation system. GPM is typically used to measure flow in conventional irrigation systems.

Hydrant
See "Multi-outlet emission device."

Hydrozone
A group of plants with similar water requirements served by one irrigation valve.

Low-volume irrigation
A type of watering system (drip, bubblers, microspray, soaker hose) in which a precise amount of water is applied directly to the rootzones of plants.

Mainline
Pressurized pipe that runs from the water source to the valve manifold, generally under continuous pressure.

Manifold
A constructed base of PVC pipe consisting of "tees" spaced at specific intervals onto which individual valves are attached.

Microclimate
Areas on a property that have slightly different exposures to sun, wind, heat, humidity and precipitation.

Multi-outlet emission device
A low-volume emission device that contains several drip emitters connected to 1/4-inch distribution tubing. The tubing is then run to several different plants.

Poly pipe
Polyethylene is black flexible pipe popular in Xeriscape applications. Poly fittings don't require glue.

Pressure regulator
A device that reduces the water pressure in low-volume control zones to a level the system can handle, usually between 15 and 60 pounds per square inch (PSI).

PVC pipe
Is white in color, is commonly used for irrigation mainlines and valve manifolds, and is more rigid than the black or brown poly pipe .

GLOSSARY

Runtime
The number of minutes a zone on your irrigation system should run each time you water. Runtimes should be adjusted each month, as well as any time there is significant rainfall.

Schedule
A program or series of programs assigned to the controller that determines the frequency and duration of landscape watering. Schedules should be regularly adjusted according to weather — at least monthly.

Soil types
Types of soil determined by their composition. Soil is made up of sand, silt and clay particles, the percentage of each determines the soil type. Soil type will affect your irrigation design and watering schedule.

Station
Location on the controller that operates an electric valve. (i.e. station #1 = valve #1, station # 2 = valve #2)

Timer
See “Controller.”

Valve
A device that opens and closes to allow pressurized water to flow through pipes.

Valve box
An underground enclosure that protects the electrical components of valves from moisture and other damage, and provides accessibility for adjustments and repairs.

Water meter
A measuring device installed and owned by the City that records the amount of water delivered to the property.

WATER BUDGET SETTINGS FOR VARIOUS NEW MEXICO CITIES

Albuquerque

Month	Minutes per month	Minutes per week	Water Budget Setting
January	20	5	5%
February	34	8	9%
March	76	19	20%
April	146	37	38%
May	243	61	64%
June	337	84	89%
July	380	95	100%
August	341	85	90%
September	234	59	62%
October	133	33	35%
November	49	12	13%
December	24	6	6%

Carlsbad

Month	Minutes per month	Minutes per week	Water Budget Setting
January	28	7	7%
February	41	10	11%
March	89	22	23%
April	164	41	42%
May	262	66	68%
June	360	90	93%
July	388	97	100%
August	353	88	91%
September	248	62	64%
October	150	38	39%
November	62	15	16%
December	35	9	9%

Clovis

Month	Minutes per month	Minutes per week	Water Budget Setting
January	19	5	5%
February	29	7	8%
March	67	17	18%
April	134	33	36%
May	228	57	62%
June	330	82	89%
July	371	93	100%
August	334	83	90%
September	226	56	61%
October	128	32	35%
November	48	12	13%
December	24	6	6%

Gallup

Month	Minutes per month	Minutes per week	Water Budget Setting
January	0	0	0%
February	17	4	5%
March	46	11	14%
April	99	25	30%
May	178	45	55%
June	262	66	80%
July	326	81	100%
August	284	71	87%
September	189	47	58%
October	101	25	31%
November	32	8	10%
December	0	0	0%

Grants

Month	Minutes per month	Minutes per week	Water Budget Setting
January	14	3	5%
February	22	5	7%
March	52	13	17%
April	99	25	33%
May	171	43	57%
June	257	64	86%
July	300	75	100%
August	262	65	87%
September	181	45	60%
October	102	25	34%
November	38	9	13%
December	19	5	6%

Las Cruces

Month	Minutes per month	Minutes per week	Water Budget Setting
January	30	7	7%
February	44	11	11%
March	94	24	23%
April	165	41	41%
May	262	65	64%
June	366	91	90%
July	406	101	100%
August	360	90	89%
September	258	65	64%
October	157	39	39%
November	66	16	16%
December	36	9	9%

Mountainair

Month	Minutes per month	Minutes per week	Water Budget Setting
January	14	3	5%
February	22	5	7%
March	52	13	18%
April	103	26	35%
May	176	44	61%
June	257	64	89%
July	290	73	100%
August	255	64	88%
September	180	45	62%
October	101	25	35%
November	38	9	13%
December	19	5	6%

Santa Fe

Month	Minutes per month	Minutes per week	Water Budget Setting
January	0	0	0%
February	16	4	6%
March	36	9	13%
April	83	21	31%
May	149	37	56%
June	226	56	84%
July	267	67	100%
August	239	60	89%
September	160	40	60%
October	86	22	32%
November	28	7	10%
December	0	0	0%

Evapotranspiration (ET) data provided by Toro Company.
Represented as inches of moisture. Rainfall based upon 30 year average.

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PUBLIC WORKS DEPARTMENT
Larry Blair, *Director*

WATER RESOURCES DIVISION
John Stomp, *Manager*
Jean Witherspoon, *Water Conservation Officer*

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Public Works Department
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Water Conservation Office
768-3655
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www.cabq.gov/resources/